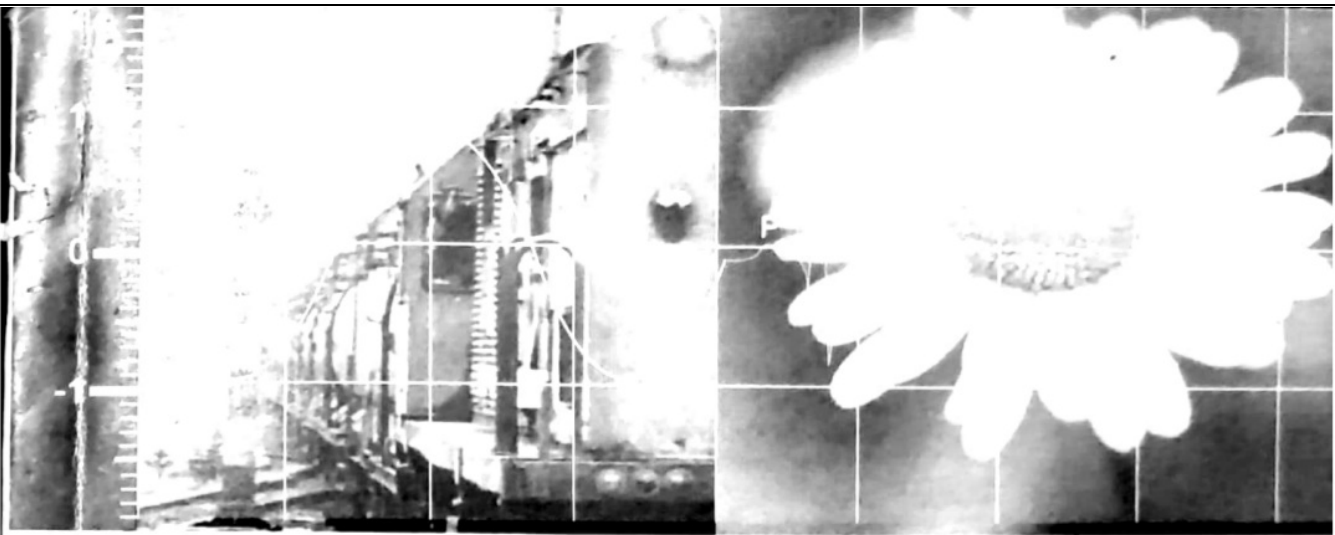


# prototype

*By* M. TOIFUR



**Proceeding of The International Seminar  
on Natural Sciences  
and Applied Natural Sciences**

Auditorium Kampus III UAD, February 17, 2007



*Hosted by:*

**FMIPA**

**Universitas Ahmad Dahlan**

**Yogyakarta**

ISBN:978-979-3812-09-0

**International Seminar on Natural Sciences  
and Applied Natural Sciences**

**Auditorium Kampus III UAD, Yogyakarta  
Saturday, February 17, 2007**

**Proceeding**

**Hosted by  
Fakultas Matematika dan Ilmu Pengetahuan Alam  
(Faculty of Mathematics and Natural Sciences)  
Universitas Ahmad Dahlan**

**Proceeding of The International Seminar on Natural Sciences  
and Applied Natural Sciences**

**Copyright © 2007 and published by FMIPA UAD. Printed in the FMIPA  
UAD. All rights reserved. No part of this book may be reproduced in any form,  
nor may it be stored in a retrieval system or transmitted in any form, without  
written permission from the publisher.**

**ISBN 978-979-3812-09-0**

## **Honorary Chairman**

**Rector of Ahmad Dahlan University  
Dean of Faculty of Mathematics and Natural Sciences**

## **Organizing Committee**

**Dr. Hj. M. Dwi Suhartati, M.Si (Chair)**  
**Nanang Suwondo, M.Pd., Dra. Listiarie B.U., M.Sc.,**  
**Tutut Hermawan, S.Pd. M.Si., Margi Sasono, M.Si., Mrs. Yuli Kusnandari,**  
**Mr. Ridwan, Dra. Sumargiyani. M.Pd., Shantiana TE, M.Si,**  
**Mursid W. Hananto, S.Kom., Mr. Rohmat, Mr. Sugiyanto,**  
**Drs. Hadi Sasongko, M.Si., Agung Budiantoro, S.Si., Suprihatin, M.Kom.,**  
**Yudi Ari Adi, M.Si., Tawar AG, M.Kom., Mr. H. Agus Riadi,**  
**Mr. Erwin Kurniadi, Imam Riadi, M.Kom., Mr. Budi Utomo**

## **Transcript-Selecting Team**

**Prof. Dr. Sumadji**  
**Prof. Dr. Hj. Nurfinaznam, S.U., Apt.**  
**Prof. Dr. Mustafa Matderis**  
**Prof. Dr. Ismail bin Mohd.**  
**Dr. Abdul Fadlil, M.T.**  
**Dr. Moh. Toifur**  
**Dr. H. R. Oktova**  
**Dr. Hj. M. Dwi Suhartanti**  
**Dr. Julan Hernadi**  
**Dr. Talib Hasyim, M.Si., M.A.**

**Image Processing Application For Tomato Ripeness Selection Using Thresholding Method**  
(*M.Riza Ferdiansyah, Kartika Firdausy, Tole Sutikno*) **Computer Science 7**

**Experiment with IP Television Service**  
(*Ahmad Ashari, Winastwan Gora Swajati*) **Computer Science 8**

**An Introduction to Linux PC Cluster at Physics Department Sriwijaya University**  
(*Menik Ariani*) **Computer Science 9**

**Expert Advisor Using Stochastic Oscillator And Average Directional Index (Adx)**  
(*Ema Wiryani Sukmaningsih, Agus Sihabuddin*) **Computer Science 10**

**An Implementation of Ant Algorithm for Routing Telecommunication Network Traffic**  
(*Anton Yudhana*) **Computer Science 11**

**Implementation Of Deposit System For Online Transactions In The Internet**  
(*Mursid W. Hananto, Yuli Astuti*) **Computer Science 12**

**Formal Software Development using RAISE Methodology**  
(*Cecilia E. Nugraheni*) **Computer Science 13**

## **PHYSICS**

**E-J Characteristic on Two Dimensional Superconductor Using Semi-implicit Integration on Time Dependent Ginzburg\_Landau Equation**  
(*Harsojo, Aang Kurtubi*) **Physics 1**

**Human Power**  
(*Bambang Murdaka Eka Jati, Dwi Ria Wahyuni*) **Physics 2**

**The Demonstration Method by using Computer Media to Improve Physics Learning Achievement for Grade 3 Student os Semester 1 in SMPNegeri 5 Jogja Academic Year 2003-2004 on The Ohm Law and Electrical Connection**  
(*Abdurrahman, Andi Rahayu Rachman*) **Physics 3**

✓ **Deposition of Cu/Ag Film at The Various Deposition Time for Resulting The High Quality Decorative Silver**  
(*Moh. Toifur*) **Physics 4**

**Free-Charge Control of Electronic Devices Using Missed Call on Telephone System**  
(*Sunardi*) **Physics 5**

**Theoretical study on the shell formation of a semiconductor quantum dot "artificial atom"**  
(*Wahyu Tri Cahyanto, Kamsul Abraha, Pekik Nurwantoro*) **Physics 6**

**Simple PC-based Physics Experiment Which Will Guide the Students to Find The Concept of Specific Heat**  
(*Nanang Suwondo*) **Physics 7**

|  |                   |
|--|-------------------|
| Automatic and Low Cost Electronic Tablets Counter for "Jamu" Home Industry<br>( <i>Nanang Surwondo, Dian Agus Maryanto</i> )   | <b>Physics 8</b>  |
| Digital Surveymeter Based On Microcontroller At 89c53<br>( <i>Setyadi Widoyosusanto, Nugroho Trisanyoto, Rill Isaris</i> )   | <b>Physics 9</b>  |
| Study Of Optical Properties Of Galium Nitrida (GaN) Thin Film By<br>Photoluminescence On The $Al_2O_3$<br>( <i>Munasir</i> )   | <b>Physics 10</b> |
| Enhancement of Physics Student Cognitive Capacity Through Improvement of Test<br>Quality<br>( <i>Dian A. K.</i> )  | <b>Physics 11</b> |
| The Calculation of Simple Thermodynamics Functions of a System Obeying Extensive<br>(0,2)-Fuzzy Statistics<br>( <i>Frenky Suseno Manik, Mirza Satriawan</i> )  | <b>Physics 12</b> |
| Identification of Foot Landmarks on Plantar Surface by Koenderink Method<br>( <i>Nopriadi, Faridah</i> )   | <b>Physics 13</b> |
| The Design of Object Position Controller for NDT's Rotating Table based on<br>Microcontroller<br>( <i>Slamet Santosa, Budi Santosa</i> )   | <b>Physics 14</b> |
| Survey On The Quality Control And Maintenance of Gamma Camera In Indonesia<br>( <i>Rill Isaris</i> )   | <b>Physics 15</b> |
| ✓ The Temperature Control System on AT89S51 Microcontroller-based Lens Saver Dry<br>Box<br>( <i>Imam Yudiantoro, Muchlas, M. Toifur, Shantiana T.E.</i> )  | <b>Physics 16</b> |
| ✓ Miniaturization Of Prototipe Of Electron Beam Machine Using Electron Source From<br>Oscilloscope<br>( <i>Moh. Toifur, Dina Eliyana, Suhari</i> )   | <b>Physics 17</b> |
| ✓ Design and Implementation of Projection Data Acquisition for Optical Tomography<br>System<br>( <i>Wahidi Zulhidayat, Margi Sasono, Moh. Toifur</i> )   | <b>Physics 18</b> |
| Standalone Detection of Atmospheric NO <sub>2</sub> using Diode-laser Based Photoacoustic<br>Detection<br>( <i>Mitrayana, T. Pierera, B.W.M. Moeskops, S. Persijn, H. Naus, F.J.M. Harren,<br/>M.A.J. Wasono, Muslim, W. Rochmah</i> ) | <b>Physics 19</b> |
| Learning The Abstract Concepts Use The Analogy Approach<br>( <i>Hainur Rasid Achmadi</i> )   | <b>Physics 20</b> |

# PROTOTYPE OF ELECTRON BEAM MACHINE USING ELECTRON SOURCE FROM OSCILLOSCOPE

Moh. Tolfur<sup>1</sup>, Dina Eliyana<sup>2</sup>, Suhari<sup>3</sup>

<sup>1</sup>Physics Dept. of Ahmad Dahlan University  
<sup>2</sup> Post Graduate Student of Science Education of Yogyakarta State University  
<sup>3</sup>Physics Graduate Student of Ahmad Dahlan University

## Abstract

In this paper, it is described miniaturization of electron beam machine using electron beam source from oscilloscope. A rectangular form of electron beam image was obtained by vertical and horizontal couples of coil supplied with regulated frequency of saw tooth current.

The result show that the maximum area yielded by electron beam sweeping was  $0.51 \text{ cm}^2$  held in the frequency and current of 37.31 Hz and 35.1 mA respectively for vertical coil couple, and 57.47 Hz and 45.83 mA respectively for horizontal coil couple. Generally, this miniature was able to descript the principle of operation of electron beam machine.

**Keywords:** electron beam machine, oscilloscope, oscillator, magnetic field.

## A. Introduction

In the industrial field, Electron Beam Machine (EBM) is most useful instrument including welding, hardening, alloyization of the metallic material in the vacuous middle and suited to the welding of abnormal material welding. For welding, there are several advantages i.e.: maximum amount of weld penetration with the least amount of heat input reduces distortion. Repeatability is achieved through electrical control systems. The electron beam machine's vacuum environment eliminates atmospheric contaminates in the weld. Exotic alloys and dissimilar materials can be welded.

The principle operating of EBM is turning the electron path on the horizontal and vertical direction, thereby resulted spraying electron until the desired area. Commonly, the main component of EBM consist of electron source, acceleration tube, High Voltage, optical system, direction system, screening system and conveyor system (Sumaryadi, *et al.*, 2001; Djoko S. P., 1998). Generally, conveyor system is needed on the applied EBM in the industrial field. Sudjatmoko (1999) has design the electron beam machine 500 KeV / 10 mA, and find out that electron source system is designed from heated chatode. Tutik Sujjati (2003) has reach the effect of the magnetic coil to the distibution of magnetic field on the both horizontal and axial direction of electron beam screened trough oscilloscope, that is intensity of magnetic field on the middle area of screen is higher compared with others.

On the laboratories scale, it is probable to produce a prototype of EBM by using oscilloscope equipment. For resulting electron beam sweeping which able to display a rectangular form, it is used two AC magnetic field deflector that are horizontal and vertical magnetic field deflectors (Chattopadhyay, *et al.*, 1989). Each of that completed with frequency



regulator. Oscillator was able for regulating frequency. In this paper it is conducted a prototype of electron beam machine in the laboratory scale using oscilloscope.

## B. Instrument

The instruments required for operating this experiment include:

1. A set of oscilloscope in the CRO (Cathode Ray Oscilloscope) experiment produced by BATAN mode of BI 764. This instrument was supplied by 4000 volt DC of power
2. Wire with diameter of 0.4 mm was formed as coil with inner diameter of 2.165 cm, outer diameter of 5.93 cm, and length of 2.65 cm.
3. Oscillator that supply the continues sawtooth wave to the coils.
4. Multimaster for measuring the current flowing on the coil.
5. Gaussmeter for obtaining magnetic field intensity produced by coils. That gaussmeter specified by GM 04 mark, 212-714 series, produced by Hirst Magnetic Instrument Ltd.
6. Digital oscilloscope for displaying the wave form outputing by oscillators and for obtaining it frequencies. This instrument was connected with personal computer (PC) to produce the picture and saved in the file.

## C. Design for experiment Instrument

The instrument used in this experiment is schemed in the Fig. 1.

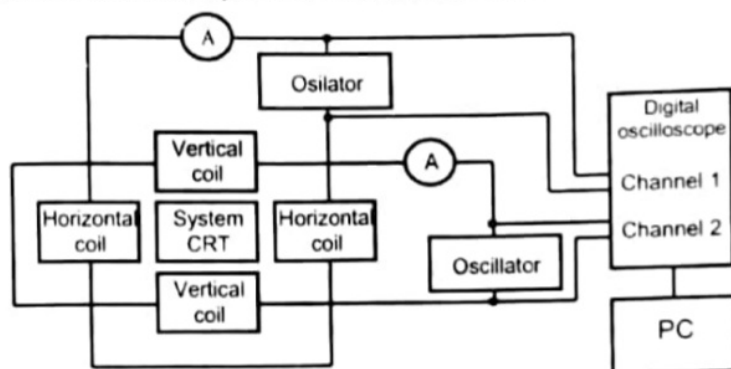


Fig. 1 Block diagram of instrument

As shown in Fig. 1, it is appear that CRT (Chatode Ray Tube) system is arrounded by couples of horizontal and vertical coils. The two coils is connected with their oscillators and the their current can viewed in amperemeter. Frequency regulation can be obtained by rotary potentiometer. Output voltage from horizontal coil is connected with chanal 1 oscilloscope, while output voltage from vertical coil is connected with channel 2 oscilloscope. For assisting the viewing the output voltage from the two coils, it is used the softview software, thereby the results can be viewed or recorded.

#### D. Experiment Methode

1. The instruments are arranged as showed in Fig. 1.
2. Setting the power supply on the on position until appear the point of electron beam in the fluorescene screen.
3. Connecting oscillator with vertical coil couple, until appear the image of electron in the horizontal line form. After the vertical coil was off, in the same way, is done on the couple of horizontal coil for finding the vertical line of electron beam.
4. Vertical coil was connected with oscillator and so horizontal ones, and then choicing the sawtooth wave mode.
5. Regulating frequencies of two osilators for getting a distribution of electron beam in the rectangular form. The larger, the sharper and the more homogen the rectangular area the better the image. After achieving this condition, we measure the lenght and wide of rectangular for obtaining the area of electron beam.
6. The next step is recording the rectangular image in the screen with digital camera and recording the voltage wave with softview software and saving it.

#### E. Results and Discussion

##### 1. Characterization of magnetic field in the coil

In Fig. 2 displayed curve correlating the electric current with magnetic field generated by coil.

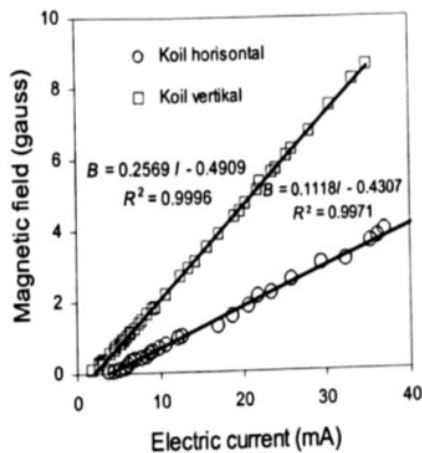


Fig. 2 Curve that correlating the electric current and magnetic field for vertical coil ( $\square$ ), and for horizontal coil ( $\circ$ ). The two coil couples are filled with iron core.

From Fig. 2, it is appear that the intensity of magnetic field ( $B$ ) is proportional to the electric current ( $I$ ). The well proportionality of two parameters can be view from each of correlation coefficient between  $B$  and  $I$ , which are not less then 99%.

## 2. Image of electron beam

In Fig. 3, it is displayed images of electron beam on the oscilloscope for couples of vertical coil (a) and horizontal coil (b). The maximum length of image is 3.0 cm held in the frequency and current of 37.31 Hz and 34.72 mA respectively. While maximum wide is 1.7 cm held on the frequency and current of 57.47 Hz and 44.07 mA respectively. From Fig. 3(b), it is appear that the intensity of image at the end of bottom of beam line is higher than it at another parts. It is due to inhomogeneity of intensity of magnetic field raised by the horizontal couple of coil.

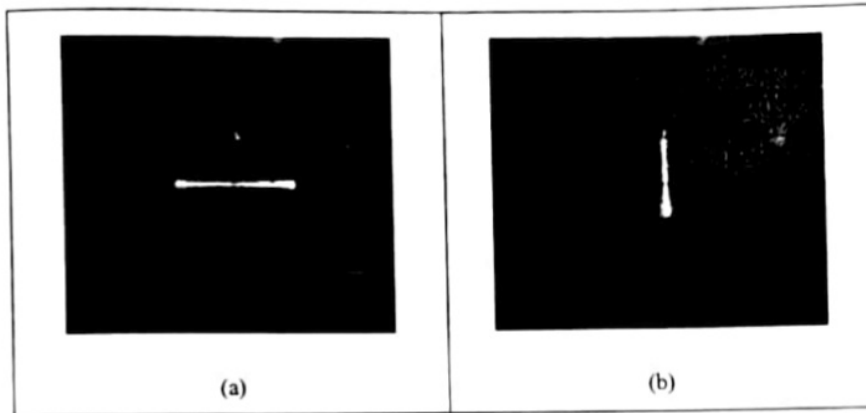
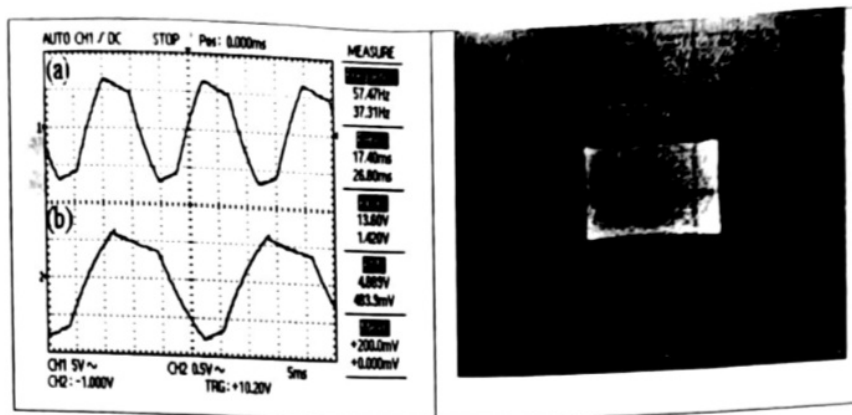


Fig. 3 Image of electron beam for couple of vertical coil (a) and horizontal coil (b).

Inhomogeneity of electron beam is caused by not coaxial position of the two coils thereby the raised magnetic force lines distribution is not symmetry. The present of cathode tube between a coil couple is difficult to arrange the two part coils in the center axial position.

If the two coils are connected with their oscillators, we get a rectangular electron beam image [Fig. 4(c)]. This image is formed by combination between voltage from horizontal coil couple at frequency and current of 57.47 Hz and 45.83 mA respectively and vertical coil couples at frequency and current of 37.31 Hz and 35.1 mA respectively. The area can be obtained is about  $5.1 \text{ cm}^2$ .



**Fig. 4** Profile of voltage for horizontal coil couple (a), vertical coil couple (b), and a rectangular electron beam image with length and wide of 3.0 cm and 1.7 cm (c).

By this image show that, making a prototype of electron beam machine in the laboratories scale by using oscilloscope has succeed though not complete yet. The incompleteness of the achieving image appears from inhomogeneity of density of electron beam in the right-bottom side that is higher compared with it in left-up ones. As mentioned above, it is caused by asymmetry distribution of magnetic field from horizontal coil couple. The proposed suggestion for finding the more homogeny image is centering the axial of horizontal coil couple.

#### F. Summary

From the discussion above we conclude that the designed EBM prototype in the laboratories scale has able to display a rectangular image of electron beam. The achieving maximum area is  $0.51 \text{ cm}^2$  held at frequency and current for horizontal coil couple 57.47 Hz and 45.83 mA respectively, and 37.31 Hz and 35.1 mA respectively for vertical coil couple.

#### REFERENCES

- Chattopadhyay, D, dkk. 1989. *Dasar Elektronika*. Jakarta: Penerbit Universitas Indonesia.
- Djoko S. P. 2004. *Teknologi Mesin Berkas Elektron*. Yogyakarta: P3TM BATAN.
- Duphk J., Kapounek, P. Horek, M. 1995. "Applications of a New Electron Beam Welding Technology in Vacuum Equipment Design", *Kovine, Zlitine, Tehnologije Letnik*, **29**, 1995, 431-432.
- Sudjatmoko, dkk. 1999. *Prosiding Pertemuan dan Presentasi Ilmiah Teknologi Akselerator dan Aplikasinya*. Yogyakarta: P3TM BATAN.
- Sumaryadi. 2001. *Prosiding Seminar Penelitian dan Pengelolaan Perangkat Nuklir*. Yogyakarta: P3TM BATAN.
- Tutik Sujati. 2003. *Konstruksi dan Pengujian Sistem Pemayar Mesin Berkas Elektron 350 KeV/10 mA*. Skripsi tidak diterbitkan. Yogyakarta: UAD.

# prototype

---

## ORIGINALITY REPORT

---

0%

## SIMILARITY INDEX

---

## PRIMARY SOURCES

---

EXCLUDE QUOTES ON  
EXCLUDE BIBLIOGRAPHY ON

EXCLUDE MATCHES OFF